

APPENDIX V

DATA ACQUISITION AND PROCESSING

V.A. Equipment



Figure 1: R/V Gloria Michelle underway

R/V Gloria Michelle is a Fisheries Research Stern Trawler who performs fisheries research in the north east. In 2005, a pole mounted Kongsberg Em3002 multibeam echosounder system was installed. The Sea Acceptance Test of the system was completed in March 11, 2006. The Hydrographic Systems Readiness Report was completed May 7, 2007. Specific rebuttals to each 2007 HSRR deficiency are included in the Descriptive Report.

Manufactuer	Device	Model Number	Serial	Firmware version	Firmware Date
Kongsberg	Em3002 PU	EM3-218353	1536	1.7.1	10/5/2005
Kongsberg	PC	HWS-10	154	N/A	N/A
Kongsberg	Transducer	Em3002	372	N/A	N/A
NOAA	Sounding pole	none	none	N/A	N/A
Seatext	SeaPath	200 (DG14)	3088	Unknown	Unknown
Seatext	SeaPath	MRU-6-E	2457	Unknown	Unknown
Furuno	GPS	GP-35	Unknown	Unknown	Unknown
Odom	Digibar Pro	DB1200	98320	v 1.08	Unknown
AML	SV Plus		4998	Unknown	Unknown

Table 1: List of survey equipment

Equipment for this removable system are located in four locations aboard Gloria Michelle. These locations include the bridge (permanent), mast (permanent), bow (removable), and laboratory (removable except for the Seapath 200 processor).

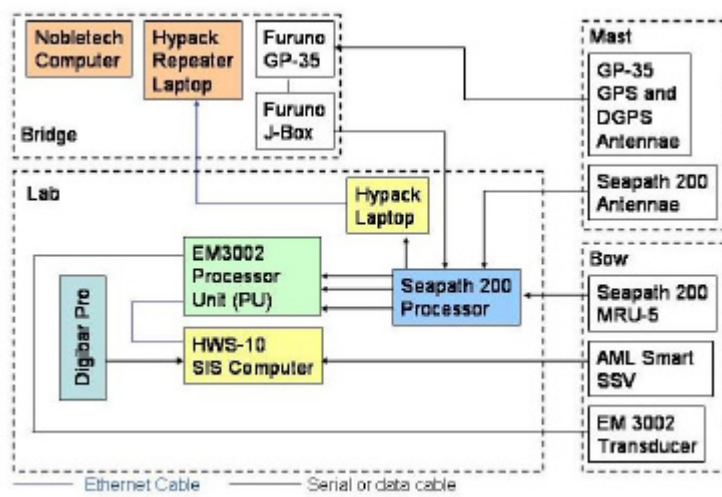


Figure 2: General equipment diagram

POSITIONING, HEADING, AND ATTITUDE SYSTEM

SEAPATH 200

R/V Gloria Michelle is equipped with a Seapath 200 attitude and positioning system. The Seapath 200 processor and GPS antennae are permanently installed on Gloria Michelle and are not removed with the Kongsberg Em3002 and Seapath MRU for use on other vessels. The Seapath GPS antennae are mounted in a fore-aft arrangement on an aluminum bar bolted to a high point on the mast. The antennae are mounted in such a way that to access the antennae or cables it is necessary to either take the whole antennae bar down to the crow's nest or use a crane 'man-cage' to access. The GPS cables are attached to the exterior of the main mast. The engine exhaust is close to the mast and will damage the GPS cables if they are not properly secured to the mast. The MRU cable impulse connector is one of the most exposed parts of this system due to significant strain as Gloria Michelle moves through the water.

Heave settings: Period – 2.505, Damping – 0.707

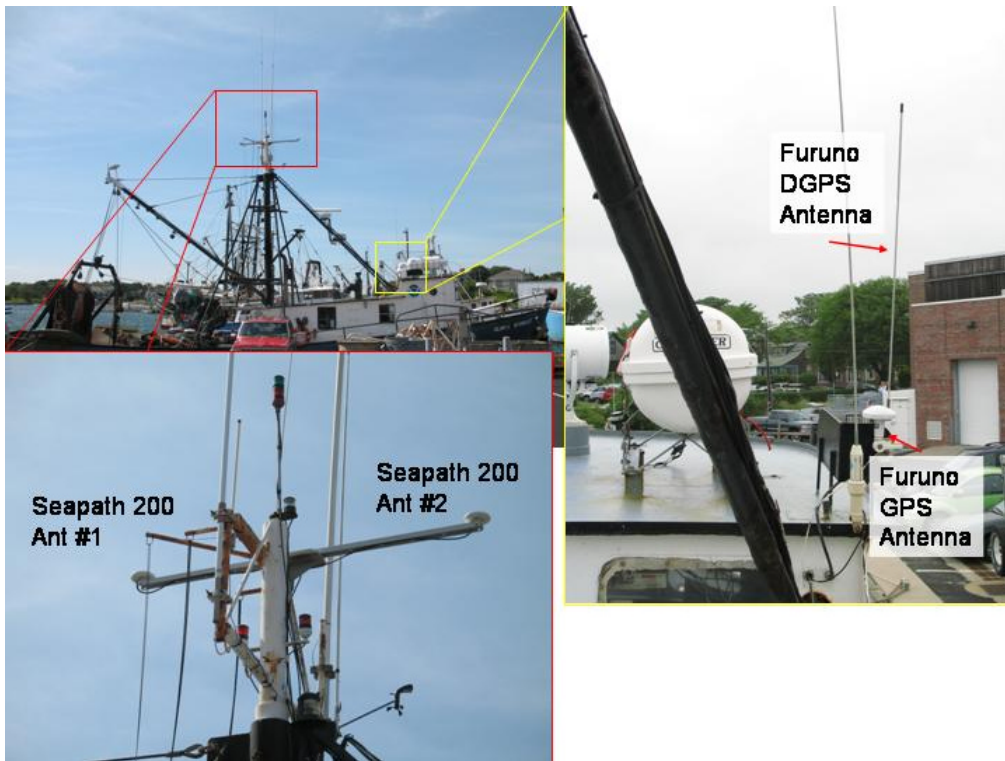


Figure 3: Seapath 200 antennae arrangements

Seapath Configuration Report

This is a summary of all the parameters configured in Seapath.

15:43:22 - Sun 24 Jun 2007 (local)
19:43:22 - Sun 24 Jun 2007 (GMT)

Vessel

Geometry

Vessel dimensions:

Length: 20.00 Width: 6.56 Height: 5.00 [m]

Center Of Gravity (CG) location:

CG-X: -9.60 CG-Y: 0.00 CG-Z: 2.75 [m]

Description

Vessel data:

Type:Fishing

Name:Gloria Michelle

Management:

Manager: -

Seapath:

Seapath owner: -

Owner:-

Country of origin:

Phone number:

Seapath Manager:

Sensor

GPS Geometry

Antenna Lever Arm

From CG to antenna #1:
X: -1.250 Y: -0.378 Z: -9.652 [m]

GPS Processing Settings

Height Aiding:
Aid mode: Off Aided height: 0.000 [m]
SV Masking:
Elevation: 10.00 [deg]

RTK Search Mode: NORMAL
Range Rate Corrections: OFF
Use GEO ranges in position solution: TRUE

GPS Reference stations

Differential Corrections:
Age Limit: 60.00
Use only stations: <Empty>
Force stations: <Empty>
Ignore stations: <Empty>

SBAS

SBAS Enable: Automatic mode

SBAS Decode: Decode any satellites

Enable SBAS WAAS Testmode: FALSE

GPS Antenna Configuration

Baseline length: 2.505[m] Heading offset: -2.02[deg] Height difference: -0.089[m]

Attitude Processing

Max pitch and roll angles: 15.00
Max average pitch and roll angles: 7.00

MRU Geometry

MRU Lever Arm
From CG to MRU:
X: 10.464 Y: 0.000 Z: 2.060 [m]
MRU Mounting Angles:
Roll: -90.00 Pitch: 0.00 Yaw: 90.00 [deg]

MRU Heave Filter

Filter Mode: Hydrographic survey
Heave mean level is roll/pitch dependent.
Filter Parameters:
Period: 2.50 [s] Damping: 0.707 []

Measurement Points

Geometry

MP1:
Name: Measurement Point #1
From CG to MP; X: 10.465 Y: 0.000 Z: 2.337 [m]
MP2:
Name: Measurement Point #2
From CG to MP; X: 0.000 Y: 0.000 Z: 0.000 [m]
MP3:
Name: Measurement Point #3
From CG to MP; X: 0.000 Y: 0.000 Z: 0.000 [m]

MP4:

Name: Measurement Point #4

From CG to MP; X: 0.000 Y: 0.000 Z: 0.000 [m]

Data Interface

Host Common

Common Host Settings:

NMEA identification: IN
Binary Message Token: 42

Network Common

Common Network Settings:

IP Network Address: 192.168.1.10
IP Network Mask: 255.255.255.0
NMEA Identification: IN
Binary Message Token: 42
FTP Server Password: seapath

Input

Data Interface - Input Configuration

Device	Properties	Format
GPS Receiver #1	com11 38400 n 8 1	
GPS Receiver #2	com13 38400 n 8 1	
MRU	com12 57600 n 8 1 rs-232	
Gyro	com9 9600 n 8 1 rs-232	<disabled>
DGPS Link #0	com10 4800 n 8 1 rs-232	RTCM, RollOn, 6of8
DGPS Link #1	com0 9600 n 8 1 rs-232	<disabled>
DGPS Link #2	com0 9600 n 8 1 rs-232	<disabled>
DGPS Link #3	com0 9600 n 8 1 rs-232	<disabled>
OpCom	com1 9600 n 8 1	

Output

Data Interface - Output Configuration

Device	Properties	MP#	Interval	Option	Format
Host Out #1	com5 9600 n 8 1 rs-232	1 - Measurement Point #1	1.00	0	NMEA
Host Out #2	com6 19200 n 8 1 rs-232	1 - Measurement Point #1	0.01	0	Simrad
EM3000/Hipap					
Host Out #3	com8 9600 n 8 1 rs-232	1 - Measurement Point #1	1.00	0	NMEA
Host Out #4	com7 9600 n 8 1 rs-232	0 - CG	0.10	0	NMEA
Host Out #5	com9 9600 n 8 1 rs-232	0 - CG	1.00	0	<disabled>
Host Out #6	com16 9600 n 8 1	0 - CG	1.00	0	<disabled>
Host Out #7	com17 9600 n 8 1	0 - CG	1.00	0	<disabled>
Host Out #8	com18 9600 n 8 1	0 - CG	1.00	0	<disabled>
Network Out #1	Port:3001, UDP/IP	0 - CG	1.00	0	<disabled>
Network Out #2	Port:3002, UDP/IP	0 - CG	1.00	0	<disabled>
Network Out #3	Port:3003, UDP/IP	0 - CG	1.00	0	<disabled>
Network Out #4	Port:3004, UDP/IP	0 - CG	1.00	0	<disabled>
Network Out #5	Port:3005, UDP/IP	0 - CG	1.00	0	<disabled>
Network Out #6	Port:3006, UDP/IP	0 - CG	1.00	0	<disabled>
Network Out #7	Port:3007, UDP/IP	0 - CG	1.00	0	<disabled>
Network Out #8	Port:3008, UDP/IP	0 - CG	1.00	0	<disabled>
Analog Out #1	Channel:1, g:0.00,o:0.00	0 - CG	NA	NA	<disabled>
Analog Out #2	Channel:1, g:0.00,o:0.00	0 - CG	NA	NA	<disabled>
Analog Out #3	Channel:1, g:0.00,o:0.00	0 - CG	NA	NA	<disabled>

FURUNO GP-35 GPS

Differential correctors to the Seapath 200 were supplied from the Furuno GP-35 GPS mounted on the aft starboard overhead on the bridge. The output from this GPS is distributed via a white plastic junction box in the cabinet below the GPS mounted on the aft bulkhead. This junction box provides NEMA position, course made good, and speed to the navigation computer and to computers and equipment specific to the other missions of Gloria Michelle. RTCM correctors are sent from the junction box to the Seapath processing unit.



Figure 4: GP-35 Bridge display



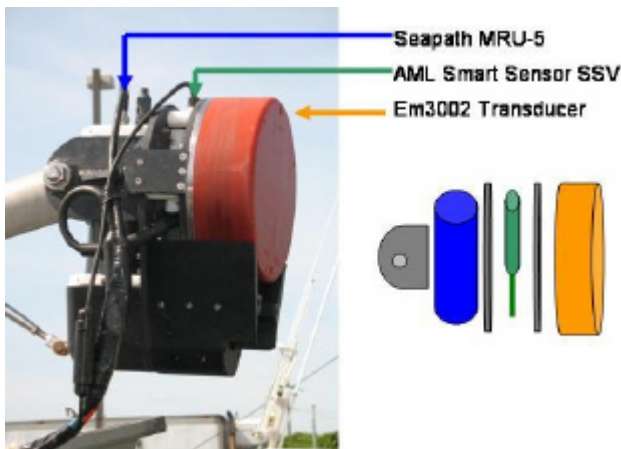
Figure 5: GP-35 junction box

SOUNDING SYSTEM

KONGSBERG EM3002 MULTIBEAM ECHOSOUNDER

The Kongsberg Em3002 is a high resolution MBES with dynamically focused beams with roll and pitch stabilization. With the pitch and roll stabilization, the system is able to maintain a constant swath with even in rough conditions, minimizing data gaps and holidays. This 300 kHz MBES system has a typical maximum survey depth of 150 meters. Besides bathymetry, the Em3002 MBES records beam time series information,

allowing for high quality backscatter data.



The Kongsberg Em3002 processing unit received attitude, time, position, and 1 PPS from the Seapath 200. The Kongsberg Em3002 processing unit was connected to the WS10 workstation via an ethernet connection.

Figure 6: Pole bow mount assembly

The Kongsberg Em3002 transducer was attached to a purpose built assembly which also housed the Seapath 200 MRU and AML SV Plus. The assembly was mounted on a pole which could be deployed on the bow as needed. Once in place, the pole and assembly were rigid.

Acquisition settings for this survey remained consistent through out the survey. The Equiangular beam spacing was used to maximize backscatter quality. Swath angular coverage was set to 60 degrees port and starboard, except for development line over wreck when the coverage was reduced to 40 degrees port and starboard. The ping Hz rate was monitored in real time during acquisition. The ping Hz rate was then compared to the vessel speed in meters per second. The Em3002 exceeded the NOAA requirements for 3.2 pings/3 meters along track during the entire survey. The depth solution of this system was compared to a sounding pole. See below for detailed configuration settings.

SETTINGS

Position: Com 1 9600,8,n,1 GGA, ZDA, HDT

Attitude/Heading : Com 2

Angular Offsets/Offset Angles

Attitude 1, Com 2 Roll 1.7, Pitch -0.5

Acquisition settings

Sector coverage

Port 60, stbd 60

Coverage 300, 300

Angular coverage mode: Manual

Beam spacing: eqangle

Transmit control:

Beam width: Normal

Along direction: 0

Max ping freq: 40

Pitch stabilization on

Filter off

Absorption coefficient

Source: salinity

Salinity 33 parts per thousand

Advanced parameters

Pulse length: 150 us

Bandwidth 8 khz

SIS Processor Unit Parameters

///
Database Parameters

///
Seafloor Information System

///
Kongsberg Maritime AS

///
Saved: 2007.06.27 08:38:58

```

//# Build info:
/* SIS:      [Version: V3.3.2, Build: 88, Label: , CD generated: Mon Nov 20
15:38:15 2006]
[Fox ver = 1.4.34]
[db ver = 12, proc = 12.0]
[OTL = 4.0.118]
[ACE ver = 5.4.10]
[Coin ver = 2.4.4]
[Simage ver = 1.6.2a]
[Dime ver = DIME v0.9]
[STLPort ver = 461]
[FreeType ver = 2.1.9]
[TIFF ver = 3.8.2]
[GeoTIFF ver = 1230]
[GridEngine ver = 2.2.3]

/* Language      [3] //# Current language, 1-Norwegian, 2-German,3-English

/* Type          [3020]
/* Serial no.    [372]
/* Number of heads [1]
/* System descriptor [33554432] //# 02000000

//# *****
//# Installation parameters

#{ Input Setup //# All Input setup parameters

#{ COM1 //# Link settings.

#{ Com. settings //# Serial line parameter settings.
  /* Baud rate:      [9600]
  /* Data bits       [8]
  /* Stop bits:      [1]
  /* Parity:         [NONE]
#{ Com. settings

#{ Position //# Position input settings.
  /* None           [1] [0]
  /* GKG            [1] [0]
  /* GGA            [1] [1]
  /* GGA_RTK        [1] [0]
  /* SIMRAD90       [1] [0]
#{ Position

```



```

#{ Input Formats #// Format input settings.
  #* Attitude      [0] [0]
  #* ZDA Clock      [1] [1]
  #* HDT Heading    [1] [1]
  #* SKR82 Heading  [0] [0]
  #* DBS Depth      [1] [0]
  #* DBT Depth      [1] [0]
  #* EA500 Depth    [0] [0]
  #* ROV. depth     [1] [0]
  #* Height, special purp [1] [0]
#} Input Formats

#} COM1

#{ COM2 #// Link settings.

  #{ Com. settings #// Serial line parameter settings.
    #* Baud rate:    [19200]
    #* Data bits     [8]
    #* Stop bits:    [1]
    #* Parity:       [NONE]
  #} Com. settings

  #{ Position #// Position input settings.
    #* None          [0] [1]
    #* GGK           [0] [0]
    #* GGA           [0] [0]
    #* GGA_RTK       [0] [0]
    #* SIMRAD90      [0] [0]
  #} Position

  #{ Input Formats #// Format input settings.
    #* Attitude      [1] [1]
    #* ZDA Clock      [0] [0]
    #* HDT Heading    [0] [0]
    #* SKR82 Heading  [0] [0]
    #* DBS Depth      [0] [0]
    #* DBT Depth      [0] [0]
    #* EA500 Depth    [0] [0]
    #* ROV. depth     [0] [0]
    #* Height, special purp [0] [0]
  #} Input Formats

#} COM2

#{ COM3 #// Link settings.

```

```

#{ Com. settings //# Serial line parameter settings.
  /* Baud rate:      [9600]
  /* Data bits      [8]
  /* Stop bits:     [1]
  /* Parity:        [NONE]
#} Com. settings

#{ Position //# Position input settings.
  /* None           [1] [1]
  /* GGK            [1] [0]
  /* GGA            [1] [0]
  /* GGA_RTK        [1] [0]
  /* SIMRAD90       [1] [0]
#} Position

#{ Input Formats //# Format input settings.
  /* Attitude       [1] [0]
  /* ZDA Clock       [0] [0]
  /* HDT Heading     [0] [0]
  /* SKR82 Heading   [0] [0]
  /* DBS Depth       [1] [0]
  /* DBT Depth       [1] [0]
  /* EA500 Depth     [0] [0]
  /* ROV. depth      [1] [0]
  /* Height, special purp [1] [0]
#} Input Formats

#} COM3

#{ COM4 //# Link settings.

#{ Com. settings //# Serial line parameter settings.
  /* Baud rate:      [9600]
  /* Data bits      [8]
  /* Stop bits:     [1]
  /* Parity:        [NONE]
#} Com. settings

#{ Position //# Position input settings.
  /* None           [1] [1]
  /* GGK            [1] [0]
  /* GGA            [1] [0]
  /* GGA_RTK        [1] [0]
  /* SIMRAD90       [1] [0]
#} Position

```

```

#{ Input Formats //# Format input settings.
  /* Attitude          [0] [0]
  /* ZDA Clock          [0] [0]
  /* HDT Heading        [0] [0]
  /* SKR82 Heading      [0] [0]
  /* DBS Depth          [1] [0]
  /* DBT Depth          [1] [0]
  /* EA500 Depth        [0] [0]
  /* ROV. depth         [1] [0]
  /* Height, special purp [1] [0]
#} Input Formats

#} COM4

#{ UDP2 //# Link settings.

  /* Com. settings //# Serial line parameter settings.
  /* N/A
#} Com. settings

#{ Position //# Position input settings.
  /* None              [1] [1]
  /* GKG               [1] [0]
  /* GGA               [1] [0]
  /* GGA_RTK           [1] [0]
  /* SIMRAD90          [1] [0]
#} Position

#{ Input Formats //# Format input settings.
  /* Attitude          [0] [0]
  /* ZDA Clock          [0] [0]
  /* HDT Heading        [0] [0]
  /* SKR82 Heading      [0] [0]
  /* DBS Depth          [0] [0]
  /* DBT Depth          [0] [0]
  /* EA500 Depth        [1] [0]
  /* ROV. depth         [0] [0]
  /* Height, special purp [0] [0]
#} Input Formats

#} UDP2

#{ UDP3 //# Link settings.

  /* Com. settings //# Serial line parameter settings.

```

```

    //# N/A
#} Com. settings

#{ Position //# Position input settings.
    /* None          [0] [1]
    /* GGK           [0] [0]
    /* GGA           [0] [0]
    /* GGA_RTK       [0] [0]
    /* SIMRAD90      [0] [0]
#} Position

#{ Input Formats //# Format input settings.
    /* Attitude      [0] [0]
    /* ZDA Clock      [0] [0]
    /* HDT Heading    [1] [0]
    /* SKR82 Heading  [0] [0]
    /* DBS Depth      [1] [0]
    /* DBT Depth      [1] [0]
    /* EA500 Depth    [0] [0]
    /* ROV. depth     [1] [0]
    /* Height, special purp [1] [0]
#} Input Formats

#} UDP3

#{ UDP4 //# Link settings.

#{ Com. settings //# Serial line parameter settings.
    //# N/A
#} Com. settings

#{ Position //# Position input settings.
    /* None          [0] [1]
    /* GGK           [0] [0]
    /* GGA           [0] [0]
    /* GGA_RTK       [0] [0]
    /* SIMRAD90      [0] [0]
#} Position

#{ Input Formats //# Format input settings.
    /* Attitude      [1] [0]
    /* ZDA Clock      [0] [0]
    /* HDT Heading    [1] [0]
    /* SKR82 Heading  [0] [0]
    /* DBS Depth      [1] [0]
    /* DBT Depth      [1] [0]

```

```

    /* EA500 Depth      [0] [0]
    /* ROV. depth      [1] [0]
    /* Height, special purp [1] [0]
#} Input Formats

#} UDP4

#{ Misc. /// Misc. input settings.
    /* External Trigger  [1] [0]
#} Misc.

#} Input Setup

#{ Output Setup /// All Output setup parameters

    /* PU broadcast enable [1] [1]

#{ Host UDP1 /// System port (PU controll) Port: 16100

#{ Datagram subscription on UDP port ///
    /* Depth            [0] [0]
    /* Raw range and beam a [0] [0]
    /* Seabed Image      [0] [0]
    /* Central Beams     [0] [0]
    /* Position          [0] [0]
    /* Attitude          [0] [0]
    /* Heading           [0] [0]
    /* Height            [0] [0]
    /* Clock             [0] [0]
    /* Single beam echosoun [0] [0]
    /* Sound Speed Profile [0] [1]
    /* Runtime Parameters [0] [1]
    /* Installation Paramet [0] [1]
    /* BIST Reply        [0] [1]
    /* Status parameters  [0] [1]
    /* PU Broadcast      [0] [0]
    /* Stave Display     [0] [0]
    /* Water Column      [0] [0]
    /* Internal, Range Data [0] [0]
    /* Internal, Scope Data [0] [0]
#} Datagram subscription on UDP port

#} Host UDP1

```

```
# { Host UDP2 #// User controlled (Logging) Port: 16101
```

```
# { Datagram subscription on UDP port #//
```

```
  #* Depth          [1] [1]
  #* Raw range and beam a [1] [1]
  #* Seabed Image    [1] [1]
  #* Central Beams   [0] [0]
  #* Position        [1] [1]
  #* Attitude        [1] [1]
  #* Heading         [1] [1]
  #* Height          [1] [1]
  #* Clock           [1] [1]
  #* Single beam echosoun [1] [1]
  #* Sound Speed Profile [0] [1]
  #* Runtime Parameters [0] [1]
  #* Installation Paramet [0] [1]
  #* BIST Reply       [1] [1]
  #* Status parameters [1] [1]
  #* PU Broadcast     [1] [0]
  #* Stave Display    [0] [1]
  #* Water Column     [0] [1]
  #* Internal, Range Data [1] [0]
  #* Internal, Scope Data [1] [0]
```

```
# } Datagram subscription on UDP port
```

```
# } Host UDP2
```

```
# { Host UDP3 #// System port (Displays) Port: 16102
```

```
# { Datagram subscription on UDP port #//
```

```
  #* Depth          [0] [1]
  #* Raw range and beam a [0] [0]
  #* Seabed Image    [0] [0]
  #* Central Beams   [0] [0]
  #* Position        [0] [0]
  #* Attitude        [0] [1]
  #* Heading         [0] [0]
  #* Height          [0] [1]
  #* Clock           [0] [0]
  #* Single beam echosoun [0] [1]
  #* Sound Speed Profile [0] [1]
  #* Runtime Parameters [0] [0]
  #* Installation Paramet [0] [1]
  #* BIST Reply       [0] [0]
  #* Status parameters [0] [0]
```

```

    /* PU Broadcast      [0] [0]
    /* Stave Display     [0] [0]
    /* Water Column      [0] [0]
    /* Internal, Range Data [0] [0]
    /* Internal, Scope Data [0] [1]
    #} Datagram subscription on UDP port

#} Host UDP3

#{ Host UDP4 //# User controlled (Subscription) Port 16103

#{ Datagram subscription on UDP port //#
    /* Depth            [1] [0]
    /* Raw range and beam a [1] [0]
    /* Seabed Image      [1] [0]
    /* Central Beams      [0] [0]
    /* Position           [1] [0]
    /* Attitude           [1] [0]
    /* Heading            [1] [0]
    /* Height             [1] [0]
    /* Clock              [1] [0]
    /* Single beam echosoun [1] [0]
    /* Sound Speed Profile [1] [0]
    /* Runtime Parameters [1] [0]
    /* Installation Paramet [1] [0]
    /* BIST Reply         [1] [0]
    /* Status parameters  [1] [0]
    /* PU Broadcast       [1] [0]
    /* Stave Display      [1] [0]
    /* Water Column       [1] [0]
    /* Internal, Range Data [1] [0]
    /* Internal, Scope Data [1] [0]
    #} Datagram subscription on UDP port

#} Host UDP4

#} Output Setup

#{ Clock Setup //# All Clock setup parameters

#{ Clock //# All clock settings.
    /* Source:          [1] //# External ZDA Clock
    /* 1PPS Clock Synch. [1] [1]
    /* Offset (sec.):     [0]
    #} Clock

```

```

#} Clock Setup

#{ Settings #// Sensor setup parameters

  #{ Positioning System Settings #// Position related settings.

    #{ COM1 #// Positioning System Ports:
      ** P1T          [1] #// Datagram
      ** P1M          [1] #// Enable position motion correction
      ** P1D          [0.000] #// Position delay (sec.):
      ** P1G          [WGS84] #// Datum:
    #} COM1

  #} Positioning System Settings

  #{ Motion Sensor Settings #// Motion related settings.

    #{ COM2 #// Motion Sensor Ports:
      ** MRP          [RP] #// Rotation (POSMV/MRU)
      ** MSD          [0] #// Motion Delay (msec.):
      ** MAS          [1.00] #// Motion Sensor Roll Scaling:
    #} COM2

  #} Motion Sensor Settings

  #{ Active Sensors #//
    ** APS          [0] [COM1] #// Position:
    ** ARO          [2] [COM2] #// Motion:
    ** AHE          [2] [COM2] #// Motion:
    ** AHS          [2] [COM2] #// Heading:
  #} Active Sensors

#} Settings

#{ Locations #// All location parameters

  #{ Location offset (m) #//

    #{ Pos, COM1: #//
      ** P1X          [0] #// Forward (X)
      ** P1Y          [0] #// Starboard (Y)
      ** P1Z          [0] #// Downward (Z)
    #} Pos, COM1:

    #{ Pos, COM3: #//

```



```

    #* P2X          [0.00] #// Forward (X)
    #* P2Y          [0.00] #// Starboard (Y)
    #* P2Z          [0.00] #// Downward (Z)
#} Pos, COM3:

#{ Pos, COM4/UDP2: #//
    #* P3X          [0.00] #// Forward (X)
    #* P3Y          [0.00] #// Starboard (Y)
    #* P3Z          [0.00] #// Downward (Z)
#} Pos, COM4/UDP2:

#{ Sonar head 1: #//
    #* S1X          [0.00] #// Forward (X)
    #* S1Y          [0.00] #// Starboard (Y)
    #* S1Z          [0.00] #// Downward (Z)
#} Sonar head 1:

#{ Attitude 1, COM2: #//
    #* MSX          [0.00] #// Forward (X)
    #* MSY          [0.00] #// Starboard (Y)
    #* MSZ          [0.00] #// Downward (Z)
#} Attitude 1, COM2:

#{ Attitude 2, COM3: #//
    #* NSX          [0.00] #// Forward (X)
    #* NSY          [0.00] #// Starboard (Y)
    #* NSZ          [0.00] #// Downward (Z)
#} Attitude 2, COM3:

#{ Waterline: #//
    #* WLZ          [0] #// Downward (Z)
#} Waterline:

#{ Depth Sensor: #//
    #* DSX          [0.00] #// Forward (X)
    #* DSY          [0.00] #// Starboard (Y)
    #* DSZ          [0.00] #// Downward (Z)
#} Depth Sensor:

#} Location offset (m)

#} Locations

#{ Angular Offsets #// All angular offset parameters

#{ Offset angles (deg.) #//

```

```

#{ Sonar head 1: //#
  #* S1R          [0] //# Roll
  #* S1P          [0] //# Pitch
  #* S1H          [0] //# Heading
#} Sonar head 1:

#{ Attitude 1, COM2: //#
  #* MSR          [1.7] //# Roll
  #* MSP          [-.5] //# Pitch
  #* MSG          [0]  //# Heading
#} Attitude 1, COM2:

#{ Attitude 2, COM3: //#
  #* NSR          [0.00] //# Roll
  #* NSP          [0.00] //# Pitch
  #* NSG          [0.00] //# Heading
#} Attitude 2, COM3:

#{ Stand-alone Heading: //#
  #* GCG          [0.00] //# Heading
#} Stand-alone Heading:

#} Offset angles (deg.)

#} Angular Offsets

#{ ROV. Specific //# All ROV specific parameters

#{ Depth/Pressure Sensor //#
  #* DSF          [1.0000000000] //# Scaling:
  #* DSO          [0.0000000000] //# Offset:
  #* DSD          [0.00]  //# Delay:
  #* DSH          [NI]  //# Disable Heave Sensor
#} Depth/Pressure Sensor

#} ROV. Specific

#{ System Parameters //# All system parameters

#{ BS Offset and TX Freq. //#

#{ Sonar head 1: //#
  #* GO1          [0.0]  //# BS Offset (dB)
  #* FX1          [2]  //# TX Freq. (kHz) 300
#} Sonar head 1:

```

```

#} BS Offset and TX Freq.

#} System Parameters

///

```

// *****

```



```

// Runtime parameters

```



```

#{ Sounder Main //

```



```

#{ Sector Coverage //

```



```

#{ Sonar Head 1 angle (deg.): //

```



```

 #* MPA [60] // Port

```



```

 #* MSA [60] // Starboard

```



```

#} Sonar Head 1 angle (deg.):

```



```

#{ Coverage (m): //

```



```

 #* MPC [300] // Port

```



```

 #* MSC [300] // Starboard

```



```

#} Coverage (m):

```



```

 #* ACM [0] // Angular Coverage mode: MANUAL

```



```

 #* BSP [1] // Beam Spacing: EQANGLE

```



```

#} Sector Coverage

```



```

#{ Depth Settings //

```



```

 #* FDE [0] // Force Depth (m)

```



```

 #* MID [1] // Min. Depth (m):

```



```

 #* MAD [100] // Max. Depth (m):

```



```

#} Depth Settings

```



```

#{ Transmit Control //

```



```

 #* YPS [1] // Pitch stabilization

```



```

 #* BMW [0] // Beam Width: NORMAL

```



```

 #* TXA [0] // Along Direction (deg.):

```



```

 #* PRF [40] // Max. Ping Freq. (Hz):

```



```

#} Transmit Control

```



```

#} Sounder Main

```



```

#{ Sound Speed //

```



```

#{ Sound Speed at Transducer //

```



```

 #* Sound velocity probe [1] [0]

```



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```

```

    ** SHS          [0] /// Source SENSOR
    ** SST          [15250] /// Sound Speed (dm/sec.):
    ** Sensor Offset (m/sec [0.0] ///
    ** Filter (sec.): [5] ///
#} Sound Speed at Transducer

```

```

/// The ROV Specific parameters Offset and Scale is located in the Installation
Parameters part of this listing.
#} Sound Speed

```

```

#{ Filter and Gains ///

```

```

#{ Filtering ///
    ** SFS          [2] /// Spike Filter Strength: MEDIUM
    ** RGS          [1] /// Range Gate: NORMAL
#} Filtering

```

```

#{ Absorption Coefficient ///
    ** ABC          [79.636] /// 300.0 kHz
#} Absorption Coefficient

```

```

#{ Normal incidence sector ///
    ** TCA          [10] /// Angle from nadir (deg.):
#} Normal incidence sector

```

```

#} Filter and Gains

```

```

#{ Data Cleaning ///
    ** Used set:    [AUTOMATIC1] ///
    #{ AUTOMATIC1 ///
        ** PingProc.maxPingCountRadius      [10]
        ** PingProc.radiusFactor             [0.050000]
        ** PingProc.medianFactor             [1.500000]
        ** PingProc.beamNumberRadius         [3]
        ** PingProc.sufficientPointCount     [40]
        ** PingProc.neighborhoodType         [Elliptical]
        ** PingProc.timeRule.use              [false]
        ** PingProc.overhangRule.use         [false]
        ** PingProc.medianRule.use           [false]
        ** PingProc.medianRule.depthFactor   [0.050000]
        ** PingProc.medianRule.minPointCount [6]
        ** PingProc.quantileRule.use         [false]
        ** PingProc.quantileRule.quantile    [0.100000]
        ** PingProc.quantileRule.scaleFactor [6.000000]
        ** PingProc.quantileRule.minPointCount [40]
    }
}

```

```

    ** GridProc.minPoints                [8]
    ** GridProc.depthFactor              [0.200000]
    ** GridProc.removeTooFewPoints      [false]
    ** GridProc.surfaceFitting.surfaceDegree [1]
    ** GridProc.surfaceFitting.tukeyConstant [6.000000]
    ** GridProc.surfaceFitting.maxIteration [10]
    ** GridProc.surfaceFitting.convCriterion [0.010000]
    ** GridProc.surfaceDistanceDepthRule.use [false]
    ** GridProc.surfaceDistanceDepthRule.depthFactor [0.050000]
    ** GridProc.surfaceDistancePointRule.use [false]
    ** GridProc.surfaceDistancePointRule.scaleFactor [1.000000]
    ** GridProc.surfaceDistanceUnitRule.use [false]
    ** GridProc.surfaceDistanceUnitRule.scaleFactor [1.000000]
    ** GridProc.surfaceDistanceStDevRule.use [false]
    ** GridProc.surfaceDistanceStDevRule.scaleFactor [2.000000]
    ** GridProc.surfaceAngleRule.use [false]
    ** GridProc.surfaceAngleRule.minAngle [20.000000]
    ** GridProc.saveAllPings [false]
    ** SonarProc.use [false]
    ** SonarProc.gridSizeFactor [4]
    ** SonarProc.mergerType [Average]
    ** SonarProc.interpolatorType [TopHat]
    ** SonarProc.interpolatorRadius [1]
    ** SonarProc.fillInOnly [true]
#} AUTOMATIC1

#{ Seabed Image Processing #//
    ** Seabed Image Process [1] [0]
#} Seabed Image Processing
#} Data Cleaning

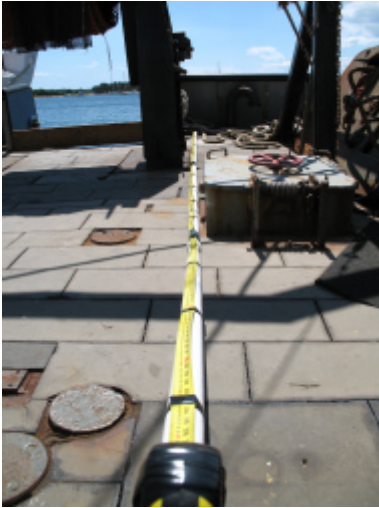
#{ Advanced param. #//

#{ Manual control #//
    ** TPL [3] #// Pulse length (us) 150
    ** BAW [1] #// Bandwidth (kHz) 8
    ** RVF [0] #// ROV filter OFF
    ** RV1 [] #// Spare1
    ** RV2 [] #// Spare2
#} Manual control

#} Advanced param.

```

SOUNDING POLE



A simple sounding pole was built to specifically test the depth solution from the Em3002 after being processed in Caris. The pole was built from four five foot sections of PVC pipe cemented together with PVC adhesive. A metal measuring tape was secured to the pole using electrical tape. This sounding pole was only used for comparison purposes with the multibeam and was not used directly for depth sounding for this survey. See Corrections to Echosoundings for more information on how this sounding pole was used.

Figure 7: Sounding pole

SOUND SPEED SENSORS

ODOM DIGIBAR PRO SOUND SPEED SPROFILER

The Odom Digibar Pro is a velocimeter employing the sing-around method of sound speed determination. The sing-around process applies Del Grosso's formula for calibration constants. The Digibar Pro tags each sound speed measurement with time and depth. The Digibar Pro uses the known distance between a transducer and associated reflector.

Casts were deployed by hand over the side when the vessel was not making way. Casts were taken at least every four hours. Casts were downloaded to the SIS computer using



Hyperterminal by using the com port interface cable for the Digibar. Casts were output in a CSV format and converted using Velocwin into SIS and Caris friendly formats. Casts were extended to 12000 meters for the SIS software.

Casts were recorded by a depth interval of 0.5 m except when current was strong. When strong currents prevented achieving desired depths the logging interval was changed to time at an interval of one second.

Cast parameters: Depth average 4, Vel average 1
Probe constants: Gradient: 3342, Intercept: 2640
Data transfer: 19200,8,n,1

Figure 8: Personnel deploying Odom Digibar aboard Gloria Michelle

APPLIED SYSTEMS LIMITED SMART SV

The AML Smart SV was mounted in the pole head assembly above the Em3002 transducer. The sensor was configured to continuously output sound speed values to the SIS computer through a junction box located in the equipment rack with the data storage devices. The junction box provides power the sensor and passes the NMEA data to the HWS-10 SIS computer.

OTHER EQUIPMENT

WILCO PETITE PONARO BOTTOM SAMPLER

The Wilco Petite Ponaro bottom sampler is part of the University of New Hampshire Center of Coastal and Ocean Mapping (CCOM) inventory and was loaned out for this project. The sampler uses a spring release pin to close the scoops when the sampler hits bottom. The sampler was hand deployed over the side when the vessel was not making way. A block on the starboard side was used to ease hauling the unit aboard. During this survey the bottom sampler failed to trigger multiple times.

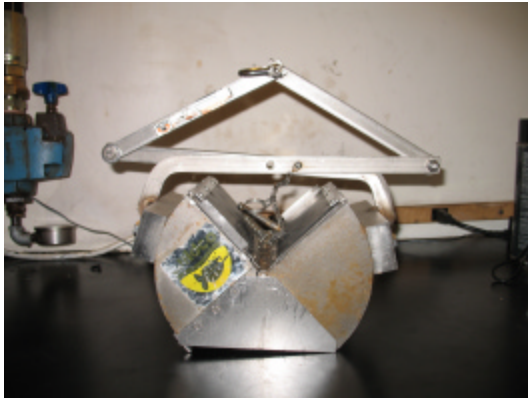


Figure 9: Wilco bottom sampler

SIMRAD AP-50 AUTOPILOT



The Simrad AP-50 autopilot was connected to the bridge Nobletech computer for line steering. Although possible, the Hypack autopilot NEMA string was not re-directed to the AP-50.

Figure 10: Simrad AP-50 controller

DATA ACQUISITION SOFTWARE

SEAFLOOR INFORMATION SYSTEM (SIS)

SIS was used for all Kongsberg Em3002 data acquisition. The real-time coverage display was used as an approximate estimate on coverage during acquisition. Sound speed profiles were applied in real-time and compared with the AML surface sound speed values to assist in the determination of when additional casts were necessary. Full water column data were acquired for select lines during the survey for research purposes.

SIS v3.3.2 build 88 CD generated nov 20 15:38:15 2006

HYPACK

Hypack was used for survey management and acquisition of detached positions only. Hypack received NMEA position, headings, and speed data from the Seapath 200. Planned line files created in MapInfo were exported to a Hypack format. Using the Windows Broadcast applet in Hypack, a laptop was set up on the bridge so the crew could see the Hypack screen. Line coordinates were provided to the crew who manually entered those positions into Nobletech.

Hypack Max v4.3a 4.3.52.0
Device driver: nmea.dll, COM1:9600,n,8,1

VELOCWIN

Velocwin v8.83 was used to process all Odom Digibar sound speed casts. Casts were processed using the 'most probable slop' algorithm and extended to 12000 meters for SIS. Caris svp files and SIS asvp files were generated.

SCC

SCC V2.1.3 dated Friday April 2 13:24:48 2004 was used to interface with the Seapath 200. This software does not allow for real time monitoring of the system and only allows for the configuration of the system. Real time monitoring was achieved by monitoring the SIS status lights, Seapath 200 LED lights, and the attached VGA monitor connected to the Seapath 200.

V.B. QUALITY CONTROL

CROSSLINES

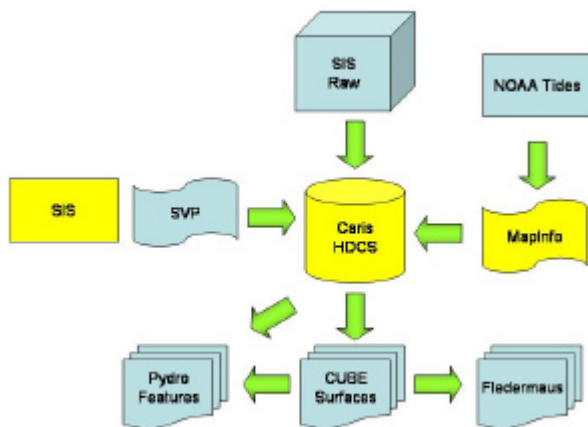
Crossline analysis and comparison were performed using two methods. Both methods used separate surfaces reflecting main scheme only and crossline only data. These surfaces were generated at the same resolution as the product surfaces at 1 meter.

The first method was to import these surfaces into Fledermaus using the IVS program DMagic. Surfaces for each area were then compared against each other using the Tools/Surface Comparison tool.

The second method was using the NOAA program Pydro. Separate surfaces for main scheme and crosslines were imported into Pydro. Thirty one Pydro check points were then selected by the hydrographer at nadir junctions of main scheme and crossline tracks. The 'show tracks' display option was selected to enable check point selection. Once the surfaces were imported and the check points selected the Pydro reports/point surface Stats tool was used to generate comparisons. See Separates for a complete listing of settings used and results for each check point.

DATA PROCESSING ROUTINES

Data were processed using a combination of Caris, MapInfo, Pydro and Fledermaus. Caris was used to apply correctors and create bathymetry surfaces. Pydro was used for feature management, crossline analysis and report generation. Fledermaus was used for crossline analysis and visualization creation. MapInfo was used for line planning and plot creation. Caris 6.1 HF# 1-13.



Caris

Data were converted and processed in Caris in the following order;

- 1) Data conversion
- 2) Water levels
- 3) Sound speed profiles
- 4) Merge
- 5) Calculate TPE

Figure 11: Data processing diagram

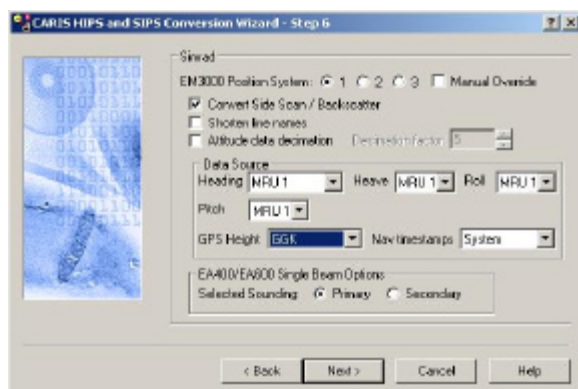


Figure 12: Data conversion settings

Water level correctors were applied using the ‘Multiple tide stations using tide zones’ and the CO-OPS provided preliminary zoning. Preliminary water levels were downloaded and applied at the end of each day. Verified water levels were later applied when those data became available.

Sound speed profiles were applied using a master SVP file that contained all of the sound speed profiles for the survey using the ‘Nearest in distance within time -8 hrs’ option.

Filters were not used for these data. During acquisition in SIS the depth range was set to a minimum depth of 10 meters and maximum depth of 70 meters. Data were not decimated. CUBE surfaces were generated at 1 meter resolution using the ‘default’ CUBE parameters.

See V.C Corrections to Echosoundings for information on TPE values used during the Calculate TPE step.

Fledermaus

Surfaces were imported into Fledermaus for analysis using the following steps:

- 1) Import all finalized surfaces into DMagic, apply surface shading, and assemble Fledermaus objects.
- 2) Open Fledermaus objects in Fledermaus
- 3) Select the Tools/Surface Difference tool for comparison of main scheme and crossline surfaces

Pydro

- 1) Insert AWOIS items, ENC chart GP’s, raster charts
- 2) Complete Pydro PSS Metadata information
- 3) Insert main scheme and crossline surfaces using the ‘Insert Weighted Grids’ option
- 4) Manually create check points
- 5) Select the reports/surface stats to create report on crosslines
- 6) Insert individual HDCS lines and generate ‘Request for Smooth Tides’ report
- 7) Features compared with surveyed soundings to determine if significant.

Caris 6.1 HF 1-13

Hyperterminal v5.1

Pydro 7.3 (r2119)

DATA ANALYSIS

Depth, uncertainty, and Std Dev layers were used to evaluate CUBE surfaces for noise and features. Significant features and those bottom features not adequately represented by the CUBE surfaces were flagged with ‘designated’. Only those noise that adversely affected the CUBE surfaces were flagged with ‘reject’. Surfaces were finalized with ‘Apply Designated Soundings’ set to ‘yes’.

V.C. CORRECTIONS TO ECHOSOUNDINGS

DYNAMIC DRAFT

Dynamic draft values determined during the 2007 HSRR were used for this survey. Data were acquired in reciprocal directions over the same portion of the seafloor in Vinyard Sound at different RPM settings. Dead in the water (DIW) data were also acquired. Surfaces from each RPM pair were compared with the DIW surfaces to determine the vertical change for each speed setting. Results were entered into the Caris HVF and applied in post-processing.

HEAVE

Heave values were calculated directly in the Seapath 200 and referenced to the transducer. The Seapath was configured to output the induced heave from pitch and roll. The result of this was that the zero heave point was at between -0.6 and -0.8 meters. Heave values were applied by SIS during acquisition.

WATER LEVEL

Water level observations from the NOAA Boston, MA tide gauge were downloaded and applied in Cairns using the tide zone file provided by CO-OPS. Verified water level observations were downloaded after acquisition was complete and applied to all data in Cairns using the preliminary tide zone file.

SOUND SPEED

Sound speed at the transducer values were used in real time by SIS for beam forming. Sound speed profiles were downloaded from the Odom Digibar Pro and applied in SIS in real time as well as converted into Cairns format. Sound speed profiles were joined together in a single file and applied to all data in Cairns during post-processing.

PATCH TEST

Patch Test Report

Completed By Nicholas Forfinski

NOAA R/V Gloria Michelle
M-A902-TJ/GM-07
H11636

Location

The patch test was performed near the R"12" buoy, approximately 1.8 km west of the southern end of sheet B, as shown in Figure 1. The goal originally was to use the buoy block as a target for determining the timing, pitch, and heading biases; however, more suitable targets were found in a rocky area 350 meters to the south.

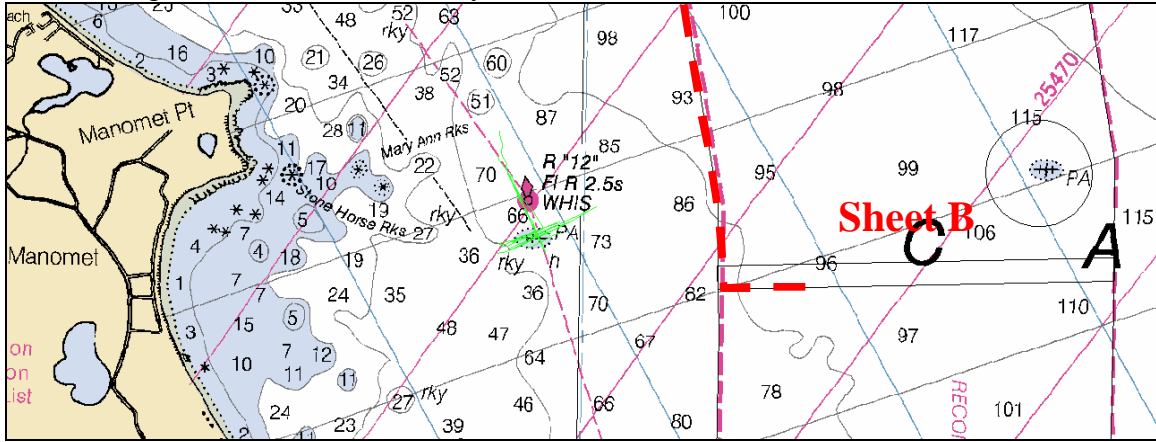


Figure 1 - Patch Test Location.

Procedure

Navigation Timing Bias

The navigation timing bias was determined by comparing coincident lines that were run at the same heading but different speeds over a conspicuous feature.

Pitch Bias

The pitch bias was determined by comparing coincident lines that were run at reciprocal headings but the same speed over a conspicuous feature.

Heading Bias

The pitch bias was determined by comparing two lines that were offset from each other such that the target of interest was located in the outer ranges of each swath.

Roll Bias

The roll bias was determined by comparing two coincident lines that were run at reciprocal headings and the same speed.

Table 1 lists the data acquired for the patch test.

Table 1 - Patch Test Data

<i>Line</i>	<i>Heading</i>	<i>Speed (kn)</i>
Timing/Pitch		
0000_20070625_162725_Gloria_Michelle	153.9	6.6
0001_20070625_163232_Gloria_Michelle¹	327.6	9.2
0002_20070625_163957_Gloria_Michelle	159.8	3.7
0003_20070625_165226_Gloria_Michelle	335.2	5.0
0004_20070625_170246_Gloria_Michelle	153.5	7.9
Heading		
0005_20070625_171125_Gloria_Michelle	244.4	6.8
0006_20070625_171602_Gloria_Michelle	65.1	7.8
0007_20070625_172213_Gloria_Michelle	249.2	7.2
0008_20070625_172600_Gloria_Michelle	69.1	7.6
0009_20070625_173003_Gloria_Michelle	66.7	7.7
0010_20070625_173448_Gloria_Michelle	243.4	7.4
0011_20070625_174138_Gloria_Michelle	64.8	8.0
0012_20070625_175338_Gloria_Michelle	245.1	7.0
0013_20070625_175827_Gloria_Michelle	67.2	8.0

¹rejected because of cross-track error

Results

The three survey personnel aboard Gloria Michelle at the time of the patch test independently derived bias estimates from the acquired data listed in Table 1, and then final values were decided upon collectively through a group review process during which each bias was applied to the data and assessed.

Table 2 - Patch Test Bias Estimates

Bias	Estimate 1	Estimate 2	Estimate 3	Implemented Value
<i>Nav Timing</i>	0.15	0.03	0.13	0.1
<i>Pitch</i>	-2.96	-3.30	-2.60	-2.6
<i>Heading</i>	-0.50	-1.00	0.33	-0.39
<i>Roll</i>	0.07	0.10	0.03	0.03

Discussion

The patch test bias estimates that were implemented in the HVF were based on the acquired Kongsberg data having been only merged in Caris. A waterline value of 1.48 meters was applied during the merge process (i.e., the “Apply” option in the waterline HVF sensor was set to ‘yes’). Variations in the speed of sound throughout the water column were accounted for real-time by loading a sound speed cast into the Kongsberg acquisition software, Seafloor Information System (SIS).

Although the patch-test bias estimates based on the acquired data having only been merged in Caris resulted in processed depths that were consistent with the sounding pole

comparison, the patch test data were also evaluated after sound-speed data were applied in Caris post-processing. The timing and gyro bias estimates were relatively similar to the initial evaluation, but the pitch-bias estimates were considerably different (close in amplitude, but different in sign). The roll bias estimate was inconclusive because the roll error varied along the length of the roll-bias lines. In addition, the data that were svp-corrected in Caris post-processing possessed in calibration mode a conspicuous roll artifact that was not observed in the processed depths when viewed in subset editor, even though the bias estimates applied in calibration mode were those with which the data were merged when viewed in subset (see Figure 2 and Figure 3). These patch test calibration mode issues have been reported to Caris as a technical support service request and are currently unresolved.

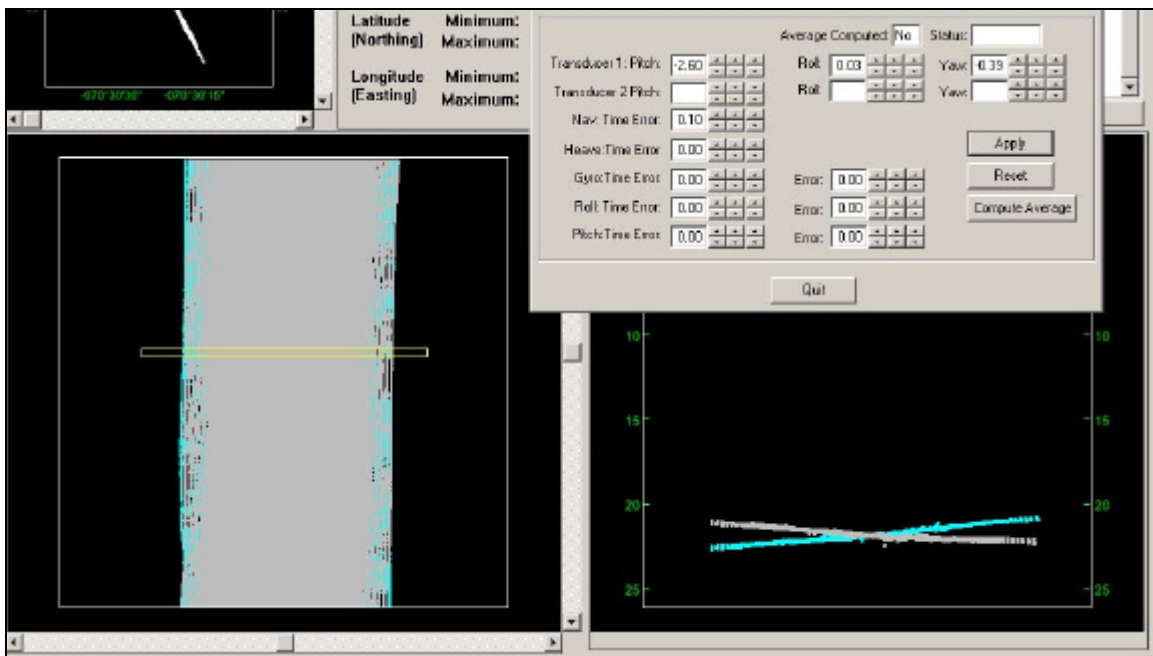


Figure 2 – Calibration Mode Roll Artifact.

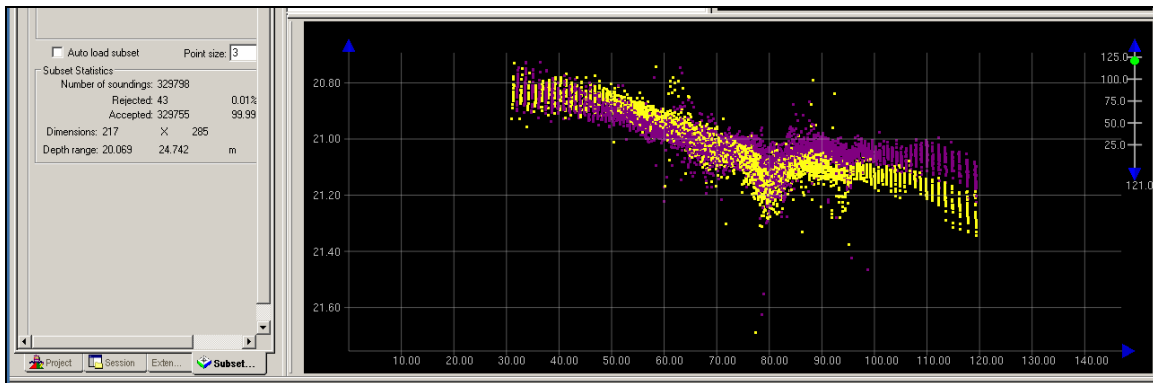


Figure 3 – Same data as shown in Figure 3, but shown in subset mode.

Bias values were applied in the Caris HVF. Bias values from other users entered into SIS were left in the acquisition software

Static draft measurements were taken daily on the port and starboard sides of the vessel while alongside. Although there were currents during some of the observations, the readings alongside and away from sea motion were considered more accurate. A steel measuring tape was used for the readings. Readings were taken from the water line to the top of the bulwark, next to the forward pad eyes on each side, two feet forward of the aft bulkhead of the aft house.

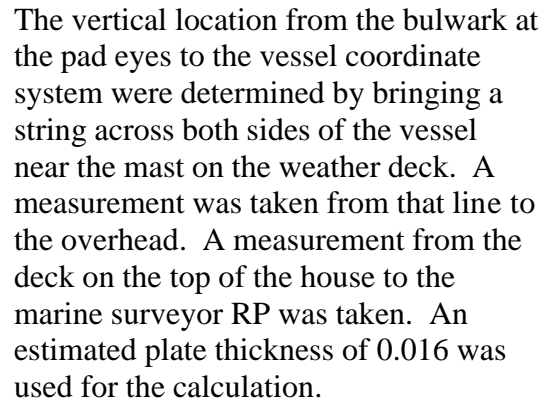
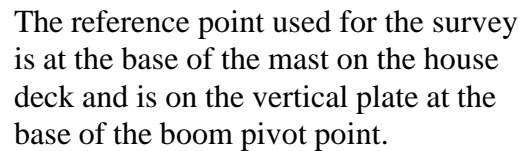


Figure 13: Tie-in of bulwark static draft measurements to IMTEC offsets



The initial static draft measurements were based on the assumption that the MRU, Em3002, and vessel were in the same reference frame during the IMTEC full survey, which was not the case. See the Sounding pole Comparison section for more information.

Figure 14: Image of bulwark to reference point measurements.

		AM		PM			
Date	DN	Port	Stbd	Port	Stbd	Average	Caris Draft
6/24/2007	175	1.580	1.640			1.610	-2.608
6/25/2007	176			1.570	1.660	1.615	-2.603
6/26/2007	177	1.580	1.630	1.600	1.615	1.606	-2.612
6/27/2007	178	1.610	1.620	1.630	1.575	1.609	-2.610
6/28/2007	179	1.660	1.590	1.665	1.600	1.629	-2.590
6/29/2007	180						
6/30/2007	181	1.700	1.600			1.650	-2.568
7/1/2007	182						
7/2/2007	183			1.650	1.600	1.625	-2.593
7/3/2007	184						
7/4/2007	185	1.680	1.670	1.665	1.635	1.650	-2.568
7/5/2007	186						
7/6/2007	187			1.675	1.661	1.668	-2.550
7/7/2007	188						
7/8/2007	189			1.660	1.650	1.655	-2.563
7/9/2007	190						
7/10/2007	191			1.655	1.662	1.659	-2.560
7/11/2007	192	1.665	1.670	1.645	1.698	1.672	-2.547
7/12/2007	193	1.675	1.685	1.675	1.685	1.680	-2.538
7/13/2007	194	1.698	1.665			1.682	-2.537

Table 2: Static draft observations

Static draft values were applied in the Caris HVF for post-processing. The actual static draft values were calculated by using an assumed mis-alignment angle between the Seapath MRU and vessel reference frame of 3.3 degrees. This value was multiplied by the lever arm distance from the center of gravity to MRU and added to the center of gravity to bulwark and center of gravity to transducer values.

3.3 degree misalignment x MRU lever arm + CG to bulwark + CG to transducer

$$\sin(3.3\text{deg}) \times 10.465 + 1.279 + 2.337 = 4.218 \text{ meters}$$

This value was subtracted from the average bulwark draft measurements for the Caris static draft entries.

SOUNDING POLE COMPARISON

A sounding pole comparison was performed on July 4, 2007 while Gloria Michelle was alongside Woods Hole, MA. The results of the comparison were that the Caris depths were on average 0.640 meters shoaler than the sounding pole measurements. This difference led to a re-evaluation of the static draft values and angular alignments of the MRU and vessel reference frames from the IMTEC marine survey.

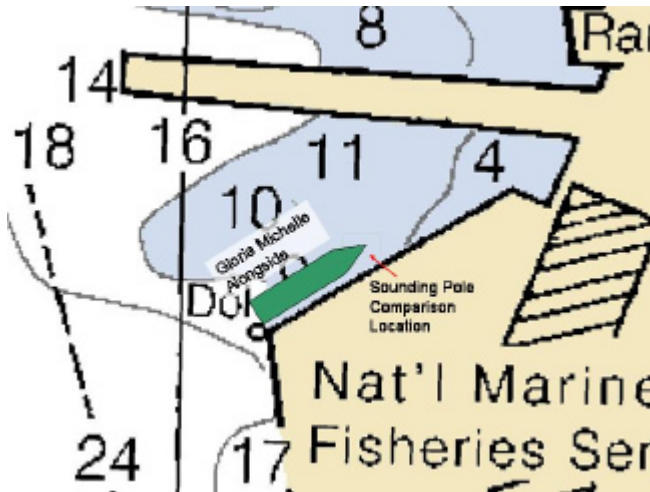


Figure 15: Sounding pole comparison location in Woods Hole, MA

The sounding pole was created from four five foot sections of 1 1/4" PVC pipe cemented together using PVC adhesive and PVC collars. A metal metric measuring tape was secured to the pole using electrical tape. The pole was deployed from the bow of Gloria Michelle, with the bottom of the pole as close as possible to the Em3002 head assembly. An

observer was stationed on a small boat near the bow of Gloria Michelle to take readings. The watch used for timing the sounding pole measurements was compared to UTC time,

with a difference of 4 hrs from the watch time and UTC time. Wave action accounted for a sounding pole measurement uncertainty of 0.05 meters. The sounding pole was re-seated on the bottom for each observation to minimize sinking in the bottom.



Separate SIS lines were acquired for each sounding comparison for a total of 12 observations over 49 minutes. Since there is a slope going up to the pier, those soundings beyond 5 degrees on each side of nadir were filtered in Caris. Data acquired before and after the sounding pole observation were also rejected in Caris. Caris data were corrected using a single sound speed cast from the location and zero tides.

Figure 16: Deployed sounding pole

Initial Caris static draft values were used based on water line observations at the centerline of the vessel and the 2005 IMTEC marine survey. All of the sounding pole comparisons differed from the Caris depths with an average difference of 0.640 meters. After changing the Caris static draft value to reflect a misalignment between the MRU and vessel reference systems, the average difference was 0.007 meters. This misalignment correction was necessary since the Seapath was configured to output heave with respect to the transducer, but references the vessel center of gravity. Since the transducer and IMU were not aligned to the vessel reference frame during installation or the IMTEC survey, there was an unaccounted for misalignment. The 2006 HSRR used a static draft value of the transducer. This value (1.48) was incorrect since it did not account for the mis-alignment or the fact the static draft readings should be referenced to the center of gravity.

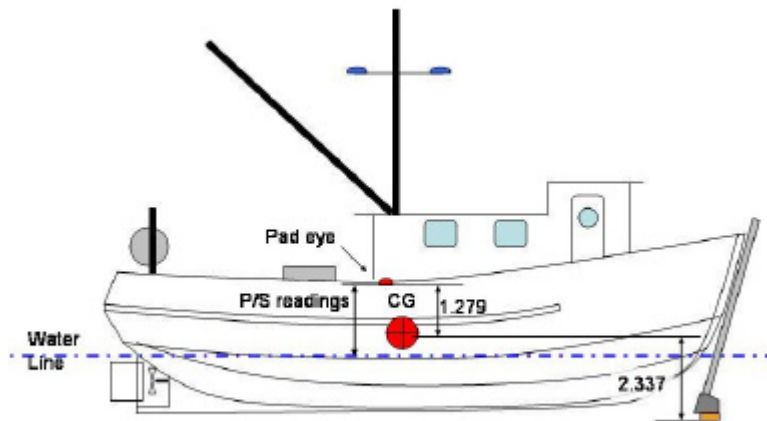


Figure 17: Vertical offsets with respect to water line observations assuming that the Seapath and vessel reference frames were the same during the IMTEC survey.

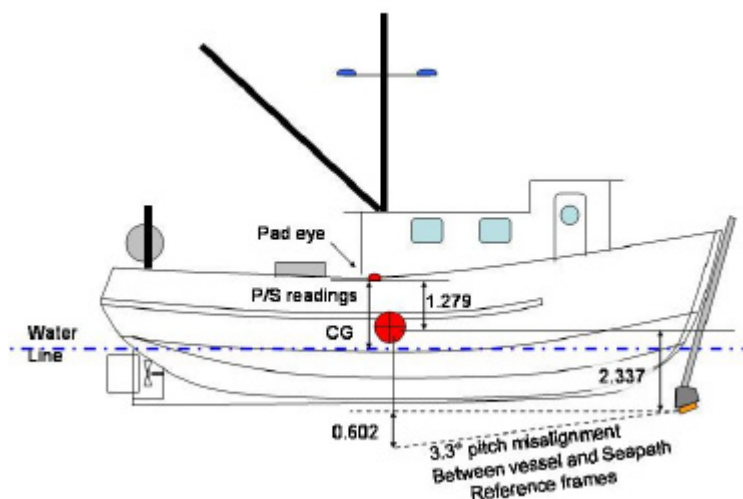


Figure 18: Vertical offsets with respect to the waterline observations assuming that there was a 3.3 degree misalignment between the Seapath and vessel reference frames during the IMTEC survey.

The resulting vertical offset from a 3.3 degree misalignment between the Seapath and vessel reference frames was added to the static draft value.

Time (LT)	Time (UTC)	Observer	Reading	SIS file name	Original Caris Depth	Difference	New Caris Depth	Difference
1255	1655	mm	3.000	134	2.379	0.621	3.025	-0.025
1308	1708	mm	2.940	135	2.315	0.625	2.972	-0.032
1310	1710	mm	2.930	136	2.331	0.599	2.967	-0.037
1313	1713	mm	2.950	137	2.310	0.640	2.968	-0.018
1316	1716	mm	2.940	138	2.304	0.636	2.965	-0.025
1320	1720	mm	2.940	139	2.304	0.636	2.941	-0.001
1324	1724	nf	2.960	140	2.280	0.680	2.936	0.024
1328	1728	nf	2.950	141	2.318	0.632	2.913	0.037
1332	1732	nf	2.970	142	2.310	0.660	2.899	0.071
1336	1736	nf	2.930	143	2.281	0.649	2.897	0.033
1340	1740	nf	2.930	144	2.265	0.665	2.891	0.039
1344	1744	nf	2.900	145	2.266	0.634	2.886	0.014
						0.640		0.007

Table 3: Sounding pole comparison results before and after accounting for the Seapath and vessel reference frame misalignment

OFFSETS

IMTEC SURVEY

An initial analysis of the December, 2005 IMTEC survey was difficult due to the ambiguity in finding measurement points, specifically the reference point for the survey

The center of reference (REF_MAST) for the IMTEC survey was a punch mark, located on the aft vertical plate under the pivot point for the aft boom at the base of the mast on the deck above the weather deck. This point was used to tie in static draft measurements with the vessel reference frame.

There were four measurement points on the Em3002 transducer for the IMTEC survey. The values indicated that the Em3002 transducer was misaligned from the vessel reference frame by 2.5 degrees.

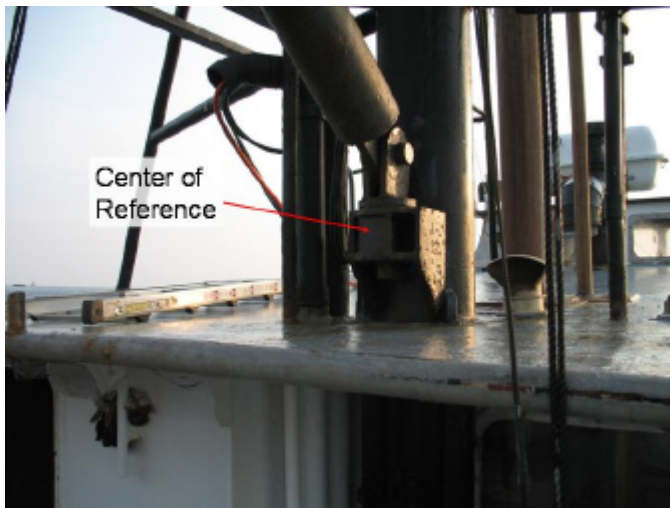


Figure 19: IMTEC center of reference

SEAPATH 200

Offsets to all of the cardinal points for the Seapath were entered into the Seaapth. The Offset from the primary (ANT #1) to center of gravity (CG), CG to MRU, and CG to transducer (MP #1) as well as the general dimensions of the vessel were entered. The CG is an imaginary point without physical location calculated by the marine surveyor who performed the IMTEC survey.

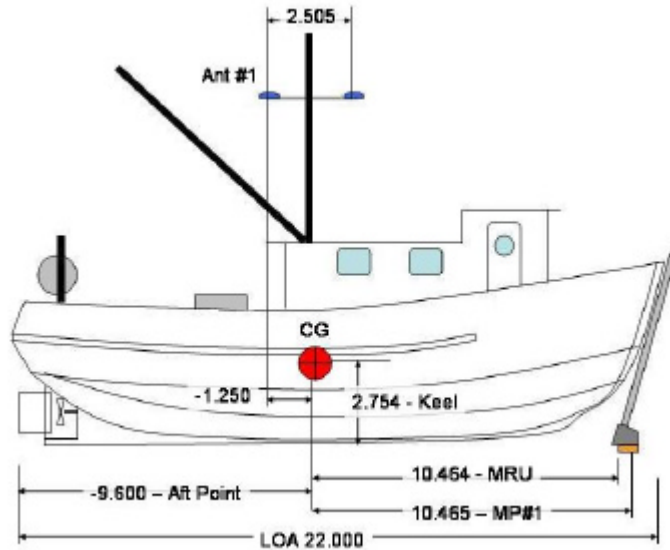
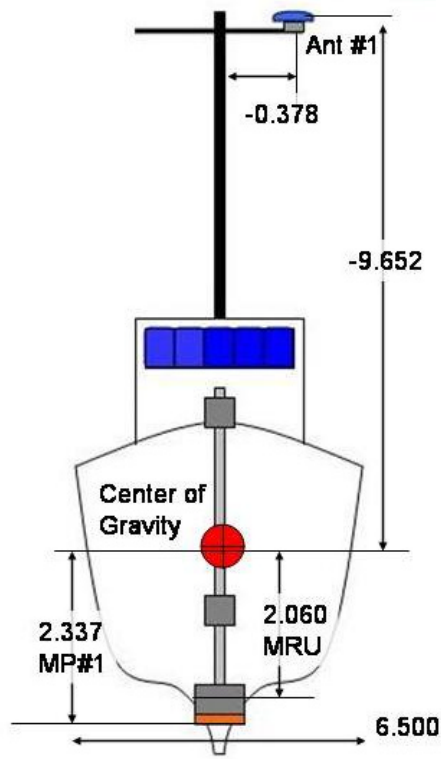


Figure 20 on the left: Offsets looking aft from the bow

Figure 21 on the right: Offsets looking to port from starboard

SIS

No offsets were entered into SIS. The static draft value was left at zero meters. Two bias values from a previous survey were left in the SIS acquisition software. These values were 1.7 roll and -0.5 pitch. SIS applies these values by adding (or subtracting) these values to the attitude output from the Seapath.

CARIS

No offsets were entered into the HVF swath 1 or sensor entries. TPE offsets from the CG to transducer were entered using the Seapath offset values. The static draft values were entered and applied in post-processing.

UNCERTAINTY AND TPE

Uncertainty values were selected based on the Caris/TPE website and NOAA Field Procedures Manual. The MRU to Trans and Nav to Trans values used the Seapath center of gravity as the center point.

HVF Entry	HIPS TPE Value	Source of Value	Comments
TPE Values -Offsets			
MRU to Trans X (m)	0.000	Direct Measurment	2005 IMTEC survey
MRU to Trans Y (m)	10.465	Direct Measurment	2005 IMTEC survey
MRU to Trans Z (m)	2.337	Direct Measurment	2005 IMTEC survey
Nav to Tran X (m)	0.000	Direct Measurment	2005 IMTEC survey
Nav to Trans Y (m)	10.465	Direct Measurment	2005 IMTEC survey
Nav to Trans Z (m)	2.337	Direct Measurment	2005 IMTEC survey
Trans Roll (deg)	0.000	Direct Measurment	2005 IMTEC survey
TPE Values -StdDev			
Motion Gyro	0.050	Caris/TPE	DGPS value
Heave % Amp	5.000	Caris/TPE	
Heave (m)	0.050	Caris/TPE	
Roll (deg)	0.020	Caris/TPE	DGPS value
Pitch (deg)	0.020	Caris/TPE	DGPS value
Position Nav (m)	1.000	Caris/TPE	DGPS value
Timing Trans (s)	0.010	NOAA/Estimated	Serial connections to PU
Nav Timing (s)	0.010	NOAA	Serial connections to PU
Gyro Timing (s)	0.010	NOAA	Serial connections to PU
Heave Timing (s)	0.010	NOAA	Serial connections to PU
Pitch Timing (s)	0.010	NOAA	Serial connections to PU
Roll Timing (s)	0.010	NOAA	Serial connections to PU
Offset X (m)	0.100	NOAA / Measurments	Based on manual measurment accuracy
Offset Y(m)	0.100	NOAA / Measurments	Based on manual measurment accuracy
Offset Z (m)	0.100	NOAA / Measurments	Based on manual measurment accuracy
Vessel Speed (m/s)	0.100	NOAA	Serial connections to PU
Loading (m)	0.000	NOAA	Daily static draft measurments
Draft (m)	0.050	NOAA	Accuracy of side measurments alongside
Delta Draft (m)	0.020	NOAA	Estimated uncertainty of DD values
MRU Align StdDev gyro	0.020	NOAA	Same value as yaw bias value
MRU Align StdDev Roll/Pitch	0.020	NOAA	Similar value as roll/pitch bias values

Table 4: TPE values entered into Caris HVF where Caris/TPE is the Caris/TPE web site and NOAA is the NOAA Field Procedures Manual

Values for the compute TPE step were taken from guidance from the Field procedures Manual. The Tide measured value is based on the sensor type. The Zoning was based on the simple zoning for the area (the majority of data are in a single tide zone). Sound speed measured was based on the observed variability of the area. Surface was based on the observed accuracy of the sound speed sensor when compared to the sound

speed profiler.